

CONVERTIBLE SOFT TOP FOR A SPORT UTILITY OR SIMILAR VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention. This invention relates
5 to the field of convertible soft tops for sport
utility and similar vehicles.

2. Discussion of the Background. Convertible soft
tops are very popular with owners of sport utility
and similar vehicles. Among other things, they
10 offer the owner the option of being able to lower
the top for an open air experience or raise it to be
covered and protected from the elements. In doing
so, it is important that the design of the top be
easy and convenient to operate. This is
15 particularly desirable as the change from the
lowered or collapsed position to the raised or
covered position often must be made fairly quickly
and many times in inclement weather. It is also
desirable that the top including its frame occupy as
20 little space as possible in its lowered or collapsed
position.

With this and other ideas in mind, the present
invention was developed. In it, a convertible soft
top is provided that can be easily and quickly moved
25 between its raised and lowered positions.
Additionally, the basic design of the foldable and
collapsible frame permits it to be adapted for use
with extended length vehicles. In such vehicles,
the rear portion or deck of the basic vehicle design
30 is extended to create more space yet the front end

as well as the driver and front passenger areas and much of the other structure and dimensions often remain essentially the same. Consequently, the frame of the convertible top and in particular the front bow often cannot simply be designed to pivot about an axis midway between its raised and lowered positions. Rather, as in the present invention, a more sophisticated arrangement for the pivotal axis is necessary. Other features of the present invention also include the addition of a sunroof to the convertible soft top and supporting structure to facilitate its safe and efficient operation between open and closed positions.

SUMMARY OF THE INVENTION

This invention involves a convertible soft top for a sport utility vehicle. The top includes a foldable, collapsible frame and a fabric attached to it. The top is movable between a raised position covering or enclosing the rear of the vehicle as well as the area of the driver and front passenger and a lowered or collapsed position. The frame has front and rear bow members with the rear bow member mounted for rotation about a first, fixed axis. The front bow member in turn is pivotally mounted to the side legs of the rear bow member for movement about a second axis spaced from the first axis.

In use, the rear bow member can be pivotally moved about the fixed axis to a collapsed position. Additionally, the front bow member can be moved with the rear bow member about the fixed axis and also pivotally moved relative to the rear bow member about the second axis. In doing so, the base of the front bow member can be moved rearwardly in the collapsed position for a distance greater than it extends forwardly in its raised position.

The top in this regard is particularly appropriate for use with extended length vehicles. In such vehicles and unlike current designs, the pivotal axis of the front bow member does not have to be exactly midway between the collapsed and raised positions. Rather, the pivotal axis of the front bow member moves or floats in a controlled manner rearwardly as the top is lowered. Consequently, the length of the rear portion of the vehicle can be extended as desired for additional rear passenger or storage space and the convertible soft top of the present invention used to cover it.

Other features of the present invention also include the addition of a sunroof to the convertible

soft top and supporting structure to facilitate its safe and efficient operation between open and closed positions. An improved clamp assembly is further included to selectively secure the soft top to the vehicle windshield and to the base of the front bow member when the sunroof is open. In this manner, the clamp assembly will be secured in a fixed position when the sunroof is open and will not rattle or undesirably hang down into the area of the driver and front passenger. Still other features of the present invention include an additional bow member pivotally mounted to the rear bow member, an arrangement to positively lock the sunroof in a lowered or closed position, and an arrangement to automatically secure the front bow member to the vehicle door frame as the top is moved from its collapsed position to its raised position.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a sport utility vehicle with the convertible soft top of the present invention in its raised position.

5 Figure 2 is a side elevational view of the raised soft top.

Figure 3 is a side elevational view of the convertible soft top in its lowered or collapsed position.

10 Figure 4 is a side elevational view of the soft top with the rear quarter window removed and the rear section of the top disengaged from the vehicle body.

15 Figure 5 is a view taken along line 5-5 of Figure 2 showing one manner in which the fabric of the top can be removably secured to the vehicle body.

Figure 6 is a perspective view of the rear section of the top disengaged from the vehicle body.

20 Figure 7 is a side elevational view of the frame of the top in its raised position.

Figure 8 is a perspective view of the frame of Figure 7.

25 Figure 9 is a side elevational view of the frame of the top in a position between its raised and lowered positions.

30 Figure 10 and 11 are schematic views of the front and rear bow members of the frame of the top as they are moved from their raised positions to their lowered or collapsed positions.

Figure 12 is an isolated, schematic view of the movement of the front bow member from its raised position to its lowered or collapsed position.

35 Figure 13 is a perspective view of one of the clamp assemblies for releasably securing the header of the front bow member to the windshield.

Figure 14 is a view taken along line 14-14 of Figure 13.

5 Figure 15 is a perspective view of the front bow member and the arrangement for automatically securing it to the door frame of the vehicle body.

Figure 16 is a view taken along line 16-16 of Figure 15.

10 Figures 17 and 18 are sequential views of the front bow member and attached block member being lowered from the position of Figure 16 to the locked or secured position of Figure 18.

Figure 19 is a view taken along line 19-19 of Figure 17.

15 Figure 20 is a side elevational view of the sunroof portion of the convertible soft top of the present invention.

20 Figures 21-23 are enlarged, sequential views of the operation of the locking sleeve member being slid from its locked position of Figure 21 to its unlocked position of Figure 23.

Figure 24 is a view similar to Figure 20 with the sunroof portion pivoted to its open position.

Figure 25 is an enlarged view taken along line 25-25 of Figure 21.

25 Figure 26 is a perspective view of Figure 25 showing how each clamp assembly can be secured to the header of the front bow member when the sunroof portion is in its open position.

DETAILED DESCRIPTION OF THE INVENTION

As shown in Figure 1, the present invention is directed to a convertible soft top 1 for a sport utility or similar vehicle 2. The vehicle 2 has a body with front and rear portions 4 and 6 spaced from each other along the longitudinal axis 8. The front portion 4 (see also Figures 2-4) has an upstanding windshield 10 and the rear portion 6 includes side panels 12 and rearward panel 14 (see also Figure 6).

The convertible soft top 1 as best seen in Figures 2 and 3 is movable between a raised position (Figure 2) and a lowered or collapsed position (Figure 3). In the raised position of Figure 2, the top 1 covers or encloses the rear portion 6 of the vehicle body as well as the area 16 of the driver and front passenger. In lowering or collapsing the top 1, the rear quarter window 3 of the top 1 in Figure 2 is preferably first removed as in Figure 4. The rear section 5 of the fabric 7 of the top 1 is also preferably disengaged (Figures 5 and 6) from the rear portion 6 of the vehicle body. The fabric rear section 5 of the top 1 in this regard can be releasably secured to the rear portion 6 of the vehicle body in any number of ways. In the illustrated one of Figures 5 and 6, the lower edge of the fabric rear section 5 is provided with a belt 9 that is releasably securable in a channel member 11 in the known manner of U.S. Patent Nos. 4,757,854 and 5,947,546. With the rear quarter window 3 removed and the fabric rear section 5 disengaged from the rear portion 6 of the vehicle body as in Figures 4 and 6, the convertible soft top 1 can then be folded from the raised position of Figure 2 to the collapsed position of Figure 3.

More specifically and as best seen in Figures 1-4 and 7, the convertible soft top 1 of the present invention has a flexible fabric 7 (e.g., vinyl or canvas) that is mounted and supported on a foldable, collapsible frame 15 (see Figure 7). The frame 15 as shown has a number of pieces including front and rear bow members 17 and 19 (see also Figure 8). Each bow member 17, 19 has an inverted, substantially U-shape (Figure 8) with the respective side legs 17', 19' of each U-shape and the base 17", 19" of each U-shape extending substantially horizontally between the respective side legs 17' and 19'.

The side legs 19' of the rear bow member 19 as illustrated in Figure 7 and 8 are respectively mounted to the legs 20' of the portion 20 of the safety bar arrangement or cage of the vehicle 2. This portion 20 of the safety bar arrangement as best seen in Figure 8 has an inverted, substantially U-shape with the side legs 20' of the U-shape extending substantially vertically upwardly from the vehicle body (see also Figure 4). The base 20" of the U-shape in Figure 8 like the bases 17" and 19" of the front and rear bows 17 and 19 then extends between the side legs 20' substantially horizontally across the vehicle body and longitudinal axis 8.

In operation as indicated above, the convertible soft top 1 can be moved from the raised position of Figure 2 to the lowered or collapsed portion of Figure 3. In doing so, the rear bow member 19 pivots about the fixed axis 21 (see Figures 7-9) relative to the side legs 20' of the safety bar portion 20. This movement is continued until the base 19" of the rear bow member 19 (Figure 9) is positioned adjacent the rearward panel 14 of the rear portion 6 of the vehicle body. The front bow member 17 in turn is pivotally moved with the

rear bow member 19 about the fixed axis 21 and also pivotally moved relative to the rear bow member 19 about the axis 23 (Figure 9). The axis 23 in this regard as shown in Figures 7 and 8 is spaced from
5 and substantially parallel to the fixed axis 21 of the rear bow member 19. Consequently, in moving from the raised position of Figures 7 and 8 to the halfway position of Figure 9 and on to the collapsed position of Figure 3, the front bow member 17 pivots
10 both about the fixed axis 21 relative to the safety bar portion 20 and about the axis 23 relative to the rear bow member 19. In doing so, the base 17" of the front bow member 17 in Figure 7 is then moved from being adjacent the windshield 10 of the vehicle
15 2 in the raised position of Figure 7 to being adjacent the rearward panel 14 and base 19" of the rear bow member 19 in the collapsed position of Figure 3.

The arrangement of the fixed pivotal axis 21 of
20 the rear bow member 19 on the safety bar portion 20' and the pivotal axis 23 of the front bow member 17 (which is fixed relative to the rear bow member 19 but floats or moves about the axis 21) creates a unique feature of the convertible soft top 1 of the
25 present invention. More specifically and as best seen in the schematic illustrations of Figure 10-12, this arrangement permits the base 17" of the front bow member 17 to be moved rearwardly along the longitudinal axis 8 of Figure 12 for a distance
30 (D+d) greater than the distance (D) the front bow member extends forwardly in the raised position (R). That is, in the raised position (R) of Figure 12, the front bow member 17 extends a distance (D) along the axis 8. However, in going to the collapsed
35 position (C), the base 17" of the front bow member 17 actually moves rearwardly a distance (D+d). The difference (d) as best seen in Figure 12 is due to

the arcuate movement of the pivotal axis 23 of the front bow member 17 about the fixed axis 21. This movement as shown both lowers the axis 23 at h and moves the axis 23 rearwardly at d. With this arrangement and unlike current designs with a fixed pivot for the front bow member 17 with the pivot positioned halfway between the points R and C, the base 17" and side legs 17' of the front bow member 17 now have more flexibility in their design. In particular, the distance (D) of Figure 12 no longer needs to be exactly half of the distance between points R and C along the axis 8.

One immediate benefit is that the rear portion 6 of the vehicle body can be extended or lengthened without affecting how the front bow member 17 fundamentally fits and operates over the door frame 30 in Figure 7. It also does not affect how the front bow member 17 releasably secures or clamps to the windshield 10 (Figures 13 and 14). That is, the convertible soft top 1 of the present invention can essentially be adapted for use with vehicles with rear portions 6 of different lengths. Further, this can be done without requiring any significant changes to the design and dimensions of the vehicle forward of the safety bar portion 20 and the vertical section 30' of the door frame 30. Importantly, this means no fundamental changes are needed to previously designed and dimensioned areas such as 16 for the driver and front passenger or the door frame 30. Changes could certainly be made to such vehicles forward of the safety bar portion 20 and door frame section 30' and the convertible soft top 1 of the present invention modified to fit them. However, by the same token, such changes need not be made yet the convertible soft top 1 of the present invention can accommodate extensions to the rear portion 6 of the vehicle body for additional seating

or storage space. This feature of the convertible soft top 1 of the present invention can be particularly advantageous in different models of the same vehicle line. In this manner, the design of the vehicle forward of the safety bar portion 20 and door frame section 30' can remain essentially the same from model to model yet varying or extended lengths of the rear portion 6 can also be offered.

Referring again to Figures 10 and 11, each side leg 17' of the front bow member 17 is preferably substantially L-shaped and corresponding side leg 19' of the rear bow member 19 preferably has a substantially matching L-shaped portion as shown. Consequently, in the collapsed position of Figure 3 and as illustrated in dotted lines in Figure 11, each L-shaped side leg 17' of the front bow member 17 and each L-shaped portion of the side legs 19' of the rear bow member substantially align adjacent one another in a neat and compact manner. The sections 31 and 33 (Figure 10) of the L-shaped side legs 17' in this regard extend along respective axes 35 and 37 that preferably intersect at an angle A greater than 90 degrees (e.g., 120 degrees). This and the floating pivotal axis 23 both aid in allowing the front bow member 17 to be adaptable to extended length vehicles.

The flexible fabric 7 of the convertible soft top 1 as indicated above is attached to the frame 15. As best seen in Figure 7, the fabric 7 can be attached to the base 17" of the front bow member 17 and to the base 19" of the rear bow member 19. The fabric 7 can also be attached to the additional, intermediate bow members 39 and 41 if desired (e.g., by overlapping flaps 42 with hook and loop fasteners, snaps, or screws). Flexible connecting straps 43 as in Figures 7-9 are also preferably attached between the bow members 39, 41, and 19 to

aid in positioning these bow members in the raised position of Figure 7. In this raised position of Figures 7, the base 17" of the front bow member 17 is adjacent the windshield 10 as previously discussed and the base 19" of the rear bow member 19 (see also Figure 2) is spaced from and above the rearward panel 14 of the rear portion 6 of the vehicle body.

In designing the convertible soft top 1 of the present invention for use with extended length vehicles, the additional bow member 41 of Figure 7 was included to better support the extended length of the fabric 7 of the top 1. As shown in Figures 7 and 8, this additional bow member 41 like bow members 17 and 19 has an inverted, U-shape with side legs 41' and a horizontally extending base 41". The side legs 41' are respectively mounted to the side legs 19' of the rear bow member 19 for pivotal movement about the axis 45. The axis 45 is substantially parallel to the axes 21 and 23 and fixed relative to axis 23. The axis 45 is also positioned along the respective side legs 19' between the base 19" and the pivotal axis 23. In operation, the additional bow member 41 is movable about the pivotal axis 45 between a collapsed position and raised position. In the collapsed position, the base 41" is adjacent the base 19" of the collapsed rear bow member 19 and in the raised position of Figure 7, the base 41" is spaced from the base 19" of the rear bow member 19 toward the front portion 4 of the vehicle body.

Referring to Figures 13 and 14 and to maintain the base 17" of the front bow member 17 in the raised position, a header section 51 is provided on the base 17" with one or more clamping assemblies 53. Each clamping assembly 53 is mounted to the header section 51 for pivotal movement about an axis

55 (see Figure 14). In operation, each overcenter hook member 57 of each clamp assembly 53 is selectively receivable in a recess 59 in the windshield 10 (Figure 14) and securable in place by lowering the clamp handle 61.

As the front bow member 17 is moved from the collapsed position of Figure 3 to the raised position of Figure 2, the convertible soft top 1 of the present invention has an arrangement as illustrated in Figures 15-19 to automatically secure each side leg 17' of the front bow member 17 to the door frame 30. This arrangement includes a block member 63 mounted on each side leg 17' and a substantially U-shaped member 65. The U-shaped receiving member 65 as illustrated in Figures 16 and 17 has two upstanding legs 65' spaced apart from one another and a base 65" extending therebetween. Additionally, the block member 63 has a beveled or inclined surface 67 (Figure 16). This beveled surface 67 is aligned as indicated in dotted lines in Figure 16 to contact the one leg 65' on the right side of the U-shaped member 65 if needed as the side legs 17' is moved downwardly. In doing so, the beveled surface 67 of the block member 63 will guide the attached side leg 17' of the front bow member 17 into a position between the legs 65' of the U-shaped receiving member 65. In the preferred embodiment, there is a block member 63 and U-shaped member 65 on each side leg 17' that are mirror images of the pair on the other side leg 17'. Consequently, the respective surfaces 67 on the block members 63 can act together in a self-centering manner to properly align and guide both block members 63 into the respective U-shaped members 65.

Each block member 63 additionally has a second beveled or inclined surface 69 (Figures 16 and 17) adjacent the recess or hole 71. In operation as the

front bow member 17 is moved to the raised position and the side leg 17' thereof is lowered from the position of Figure 16 to that of Figure 17, the second beveled surface 69 will contact the end portion 73' of the plunger 73 extending through the left side leg 65' in Figure 17 and retract the end portion 73' against the biasing force of the spring 75. Thereafter, the force of the compressed spring 75 will move the end portion 73' of the plunger 73 into the aligned recess 71 in the block member 63 and the locked or secured position of Figure 18. To further aid in the alignment or automatic guiding of the end portion 73' of the plunger 73 into the recess 71, the block member 63 also has a surface 77 (see Figure 19) with an inverted, substantially V-shape. Consequently, as the block member 63 is lowered, the plunger end portion 73' if needed will contact the inverted V-shaped surface 77 (as shown in dotted lines in Figure 19). This in turn will aid in self-centering or guiding the end portion 73' into the recess 71.

In this manner and as indicated above, the locking or securing of the plunger end portion 73' in the recess 71 of the block member 63 will then automatically occur as the front bow member 17 is moved from the collapsed position of Figure 3 to the raised position of Figures 2 and 20. To subsequently release the block member 63 from the member 65, the ring 100 of the plunger 73 in Figure 18 can simply be grasped and pulled to the left against the biasing force of the spring 75. It is noted that in the secured position of Figure 18, the section 31 (see Figure 7) of each L-shaped side leg 17' is substantially aligned with the substantially horizontally extending section 30" of the door frame 30. The door frame section 30" as shown in Figure 7 extends rearwardly from adjacent the windshield 10

to the vertically extending door frame section 30'. Also as illustrated in Figure 15, the door frame at this section 30" can be removably secured (e.g., clamped) at 22 to the forward extending portion 24 of the safety bar arrangement of the vehicle.

Referring again to Figure 20, the convertible soft top 1 of the present invention preferably includes a pivoting sunroof portion 81. In operation and with the sunroof portion 81 in the closed position of Figure 20, the segments 83 and 85 of the section 31 of the side leg 17' of the front bow member 17 extend substantially horizontally along a common longitudinal axis 87 (Figure 21). The segments 83,85 of each side leg 17' are pivotally mounted to each other for relative movement about the axis 89. In this manner, the first segment 83 and the attached base 17" of the front bow member 17 can be moved to the open position of Figure 24. In the open position of Figure 24, the base 17" and the first segment 83 are then adjacent the second segment 85 to create an open portion in the soft top adjacent the windshield 10.

In the preferred embodiment, a sleeve member 91 (see Figures 20 and 21) is mounted about the first segment 83 for sliding movement along the axis 87 (Figure 21). In the position of Figures 20 and 21 covering the pivotal axis 89, the sleeve member 91 serves to maintain the segments 83,85 in the aligned relationship of Figures 20 and 21 and the sunroof portion 81 closed. In operation, the sleeve member 91 can be slid along the axis 87 past the position of Figure 22 to the position of Figure 23 uncovering the pivotal axis 89. This in turn permits the base 17" of Figure 20 and the first segment 83 to be pivoted relatively to the second segment 85 to the open position of Figure 24. In doing so, the sleeve

member 91 is provided with side-by-side recessed portions 93 and 95 (Figure 21) along the axis 87 separated by the protruding member 97. Additionally, a detent 99 is mounted on the first segment 83. The detent 99 is spring biased outwardly through a hole in the segment 83 to an extended position (Figure 21) and is selectively receivable in the recessed portions 93,95 as the sleeve member 91 is slid along the axis 87 from Figure 21 to Figure 23.

During such sliding, the protruding member 97 of the sleeve member 91 will contact and move or depress the detent 99 (Figure 22) to a retracted position allowing the protruding member 97 to pass by the detent 99. In this manner, the depressed detent 99 will then rebound or snap back and be received in the other recessed portion 95 (Figure 23). Such rebounding can be tactually felt by the user. It can also be heard by the user as the rebounding detent 99 makes an audible click. In moving the sleeve member 91 to lock the segments 83,85 in the aligned relationship of Figures 20 and 21, the tactile feel and audible click each act as a signal to let the user know the locked position has been reached. In this locked position, the sunroof portion 81 will not inadvertently move or open unless and until the sleeve member 91 is slid to the position of Figure 23 to again uncover the pivotal axis 89. This arrangement with the locking or interfering mechanism of the detent 99 and recessed portion 93 bounded by the protruding member 97 essentially serves as a safety feature. Preferably, each side leg 17' is provided with such an arrangement. Also, it is noted that in the open position of Figure 24, the engagement of the block member 63 and the U-shaped member 65 on the door frame 30 further helps to ensure the front bow

member 17 remains securely in place even with the sunroof portion 81 open as in Figure 24.

5 The recessed portions 93,95 are preferably made as a relatively narrow channel 101 (see Figure 25) in the inner wall 103 of the sleeve member 91. The detent 99 is then preferably always confined within the channel 101 to keep the sleeve member 91 from rotating about the axis 87. The protruding member 97 in this regard is preferably shallower than the channel 101 (see Figure 25) so the spring biased detent 99 will still remain in the channel 101 even in the depressed or retracted position of Figure 22.

10 Figure 26 illustrates a further feature of the convertible soft top 1 of the present invention in which a recess 59' is provided in the underside of the header section 51 of the base 17" of the front bow member 17. In this manner and with the sunroof portion 81 in the open position of Figures 24 and 26, the hook member 57 of the clamp assembly 53 can be received in the recess 59' and the clamp handle 61 moved to lock the clamp assembly 53 in a fixed position relative to the header section 51. Consequently, the clamp assembly 53 will not be loose to rattle or hang down into the area 16 of the driver and front passenger. This is both a safety feature and a way to keep the clamp assembly 53 from making unwanted noise when the sunroof portion 81 is open.

25 While several embodiments of the present invention have been shown and described in detail, it to be understood that various changes and modifications could be made without departing from the scope of the invention.

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